

All Wrapped Up in Kudzu & Other Ecological Disasters

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*****Note: Figures may be missing from this format of the document**

Humans have had a profound impact on the environment. We have destroyed species for food. We have destroyed homes and habitats of numerous species because of our needs for space.

Some of the most interesting and also devastating impacts have been unintended outcomes of our desire to enhance or control our environment. Numerous species of plants and animals have been introduced in many, if not all, countries around the world in an attempt to secure a better life for humans. To provide a familiar food supply to those moving to a new place, domestic plants and animals were imported from one country into another country. Many of these domestic organisms were deliberately released into the wild while others escaped. Many introduced species have had a major impact on their new environments and have eliminated or now threaten native plants and animals. Also, some introduced species have entered other countries accidentally and have gone undetected for years. Perhaps they were stowaways on ships or planes, or insects on fruits unnoticed by packers.

This article includes an activity that you can do in your classroom today to reinforce the concept of and problems involved with introduced, nonnative or alien species. Following are seven vignettes about seven different plant and animal species that have become, or currently are, near ecological disasters. These species include the brown tree snake in Guam, the cane toad in Australia, coyotes in North Carolina, goats in the Galapagos Islands, the Kiskadee flycatcher in Bermuda, kudzu vine in the eastern United States, and pigs in Hawaii.

The idea of introduced or alien species is certainly not new in ecology, although it may be for some of your students. What is unique about this article is the collection of vignettes that accurately and succinctly describes past, current and continuing problems around the world. For example, Americans needed kudzu for soil stabilization; islanders needed pigs and goats to ensure a stable food supply. Our needs and wants have, in many cases, led to alien invasion, and now we are left to deal with the results of our acquisitions. Equally important is the lesson that students can learn through this activity: that the outcomes of human interaction with the environment cannot often be accurately predicted.

Suggestions for Using These Vignettes in the Classroom

Because these vignettes contain all the information needed for a lesson on introduced or alien species, they can be duplicated and used in your classes right away. Divide your students into seven groups of three or four students per group. Start each of the seven groups with only one of the vignettes to read and discuss. Provide each group member with his/her own copy of the vignette. Introduce the vignettes as current, actual scenarios. Tell the students that they are to act as a scientific team. When students are faced with problems like those presented in these scenarios, they do not necessarily know all the outcomes of a given action, but they might make predictions like the options given in the scenarios. Tell the students that all options are feasible and that one actually describes the current condition. However, they should choose the option for which they can make the best case, based on their understanding of ecological principles. Let the students in each group reach

consensus concerning the outcome and record their choice of options on their own papers. As a group they should be prepared to support their choice when class data are shared at the end of the activity. Each vignette includes an option "D" that allows students to write their own conclusion if they do not believe that one of the other three options is correct or if they have difficulty supporting one of the other three choices. After completing each vignette, rotate the vignettes so that eventually each group will have read each of the seven stories and selected or written an outcome for each.

The group reading and small group discussion are followed by entire class discussion. The teacher selects a vignette, reads it, and then asks groups for their responses. The response letters are listed on the board or overhead, using a matrix like the one on page 43, and groups are asked to defend their choices. Note: If you choose to use the matrix as an organizational tool, remind students that their small groups will complete only one line of the data table. The remaining cells of the table will be completed as class data are shared. The most important part of this class is each group's defense of its selected outcome and the teacher's discussion of the actual outcome. Therefore, you may want to require students to write a group defense of their selected response below their data table. One class period (approximately 50 minutes) needs to be devoted to reading and discussing the vignettes in small groups, while another class period or two must be spent as an

Group	snake	toad	coyotes	goats	bird	kudzu	pigs
1							
2							
3							
4							
5							
6							
7							

Figure 1. A sample matrix.

entire class sharing solutions and justifications for its choices.

Students may balk at having to choose a correct answer or having to create their own outcome for the problem presented. Teachers should emphasize to students that they are to reach conclusions based on only their own experiences and limited knowledge, as well as the applications of general ecological principles that they have studied in science classes. Teachers should also emphasize that correct answers or incorrect answers are only incidental to the ecological stories. All the detractors for each vignette are at least somewhat feasible outcomes. The purpose of this activity is to emphasize basic ecological principles, including the fact that humans have not always successfully predicted the outcomes of their actions, especially when it comes to introduced species.

The use of these vignettes in the middle school and secondary school classroom should lead to greater understanding of general ecology and an awareness that, as humans, we are great manipulators of the natural world. Throughout history we have made some silly mistakes and some grave errors, and have often failed to predict the outcomes of our ecological manipulations. Students should be encouraged to research and write vignettes about other introduced species of interest following this activity in the classroom.

The Brown Tree Snake in Guam

On the island of Guam, the forests are silent. The birds no longer sing because they no longer exist. In the 1940s, the brown tree snake, *Boiga irregularis*, arrived on Guam on military ships and planes. The nocturnal greenish-brown tree snake with large bulging eyes grows to 10 feet long. Since its arrival on Guam, it has destroyed more than 80% of the forest bird species, 66% of the native bat species, and six species of lizards. What is the outlook for the remaining wildlife on Guam?

- A. Wildlife biologists have hired native Guam residents to hunt the brown tree snake. This intervention has helped keep the brown tree snake population in check. Plans are underway to reintroduce several bird and bat species from Hawaii. Everyone is hopeful that the forests in Guam will recover and issue forth sounds of music.
- B. The brown tree snake population has continued to increase dramatically. As the snakes drape their bodies around power lines on Guam, electrical outages occur every fourth day, resulting in high costs and great inconveniences for the people on Guam. Recently, brown tree snakes have attacked human babies. In some forested areas of Guam, there are 12,000 brown tree snakes per square mile. People in other countries—like those in the U.S.—especially Hawaiians, are worried that it is only a matter of time before the brown tree snake reaches them.
- C. The mongoose was imported to control the brown tree snake population. The mongoose has done a good job of brown tree snake control. In other countries, introduction of the mongoose was a problem because the mongoose was a generalist when it came to food preferences. However on Guam, since the brown tree snake has virtually wiped out all other wildlife, the mongoose has few other food alternatives. Once the brown tree snakes are gone, though, the mongooses may be a problem. But for now, the brown tree snake population explosion has been stymied.
- D. _____

Cane Toads in Australia

In 1935, cane toads were brought to Australia to rescue the sugar cane crop from the devastation caused by two native beetles. One hundred and two toads, *Bufo marinus*, were collected from Honolulu and transported to Australia. One hundred and one toads survived the 19-day ocean voyage and began to breed. While a few problems were reported (dogs foamed at the mouth after contact with the toads, bees disappeared down toad gullets, and fowl got sick from contaminated water), these problems were discounted as agriculturists and entomologists alike heralded the toad's arrival in Australia.

However, a few problems soon emerged that were more difficult to discount. Cane beetles flew; cane toads did not fly. Cane beetles and toads preferred different habitats. Cane toads were definitely not a threat to the cane beetles; cane toads liked Australia, though.

In 1947, a chemical, benzene hexachloride, finally kept the sugarcane beetle grubs under control and the sugar cane crop was saved! In the meantime, by 1976 the most common small vertebrate in Queensland, Australia was the cane toad! Can you predict what has happened to the cane toad population in the past two decades?

- A. The cane toad population decreased precipitously this past decade. Australian scientists imported the Hawaiian hognosed snake, with a propensity for cane toads, to Australia. This Hawaiian hognosed snake has thrived in Australia, as it did in Hawaii, and has done an excellent job of keeping the cane toad population under control.
- B. The same chemical that was used to control the sugarcane beetle grubs had a systemic effect on cane toads. The pesticide caused the gel of the egg case to dissolve, resulting in the release of individual toad eggs which made them more susceptible to predacious water bugs. The cane toad population has declined and the outlook for a continuing decline of cane toads in Australia looks good.
- C. The cane toad population in Australia is booming. No one knows what to do. Cane toads found conditions great for breeding, and now in some areas of the country you find one cane toad per two square meters of lawn. The cane toad is spreading to parts of Australia that it has yet to see. Cane toads also eat everything, including an occasional sugarcane beetle or two; but insects are numerous, and cane toads have grown fat and happy in Australia. Some people like them, some people hate them, and most Australians are perplexed by this occurrence. They wish they could simply laugh and say, "I guess Australia has too much of a good thing," but the joke's on them. There doesn't seem to be anything good about the introduction of the cane toad to Australia.
- D. _____

Coyotes in North Carolina

Until the early 1900s, North Carolina and Hawaii were the only states in the U.S. that did not have established populations of coyotes. In recent years, since the early 1980s, coyotes have appeared in North Carolina because of the illegal release of coyotes by certain individuals. These individuals place coyotes in pens so that they can be chased by hounds, a practice called "coursing." The hounds, however, rarely catch the coyotes and many coyotes have escaped to establish wild populations. Can you predict what has happened recently to the coyote population in North Carolina?

- A. Coyotes are dangerous pests in North Carolina. They eat virtually everything they can find or catch, including rabbits, deer, fruit, vegetables, birds, even livestock. Coyotes cost ranchers millions of dollars every year by eating their sheep, lambs and goats.
- B. North Carolina wildlife officials, fearing a risk to children or animals that may encounter a coyote, passed a law in 1986 allowing hunters to call coyotes with electronic callers in order to shoot and kill them. They have also located and shut down several pens where coyotes were being kept for coursing purposes.
- C. Because coyotes are bigger and more fierce than red foxes, coyotes have caused the native red fox populations to relocate. These native foxes have to find new homes and often these homes are close to humans.
- D. _____

Goats on the Galapagos Islands

When the Galapagos Islands were designated National Park status in 1959, a legacy of introduced species was left behind. Dogs, cats, pigs, goats, rats, and guava plants were among the nonnative species that had been introduced by visitors, people fishing, and colonists on the Galapagos Islands. In the area around the Alcedo volcano, there is a rapidly expanding population of goats. Fewer than 20 years ago, none of these goats was found; now, there are approximately 40,000 goats. Can you predict what effect this exploding population of goats is having in the Alcedo volcano area in the Galapagos?

- A. Despite the plant clearing caused by the voracious appetites of these goats, the vegetation has survived remarkably well. This survival is due to the fact that the goats void the seeds in their solid waste, causing new plants to grow, almost as if they were replacements for the old ones.
- B. Ecosystems surrounding volcanoes are lush with living organisms, particularly plants. Despite the growing number of goats in the region, the habitat continues to thrive.
- C. The voracious appetites of the goats not only threaten the survival of several plant species in the region, but the Galapagos tortoise is endangered as well. The tortoise cannot compete with the goats for vegetation.
- D. _____

The Great Kiskadee Flycatcher (Bird) in Bermuda

There was trouble in Bermuda. One of the showy subtropical plants, oleander, had been attacked by scale insects. In 1954, lady bird beetles were imported to combat the oleander scale. However, Bermuda's Anolis lizards were insectivorous and were consuming many of the "ladybugs." In 1957, a decision was made to import the great Kiskadee flycatcher, a large aggressive bird like our blue jay in the U.S., which got its name for its call "kis ka dee." Two hundred Kiskadee flycatchers were imported from Trinidad. They were imported in an attempt to control the Anolis lizards. Can you guess what happened next and what's happening now?

- A. While it was true that Kiskadees fed on lizards, they also liked to eat large insects, soft skinned fruit, and the eggs and young of the bluebird, a native insectivorous species. The population of Kiskadees grew from 200 birds in 1957 to over 60,000 birds in 1976. The *Anolis* lizard population was not affected by the importation of the Kiskadee.

- B. The great Kiskadee flycatchers loved Bermuda and fed on insects, as flycatchers are known to do, including predacious insects that fed on the scale insects. Kiskadees especially enjoyed lady bird beetles. The Kiskadees thrived and within a 15-year time span, the oleanders had been extirpated from Bermuda.
- C. While importing Kiskadees initially seemed to be a wise decision and a good choice for biological control of *Anolis* lizards, scientists noted that the Kiskadee population was rapidly declining. Soon they discovered that Kiskadees had become a preferred food of a common hawk in Bermuda. In 1993, the last Kiskadee disappeared from the islands, and now ornithologists are studying the hawk population to see how it will respond to this decrease in its food supply.
- D. _____

Kudzu Vine in the Eastern USA

Kudzu was introduced in the United States in 1876 at the Centennial Exposition in Philadelphia, Pennsylvania. Countries had built exhibits to celebrate the 100th birthday of the U.S.; the Japanese government had constructed a beautiful garden filled with plants from its country. American gardeners were enticed by kudzu's large leaves and sweet-smelling blooms. In the 1920s, someone discovered that animals eat kudzu and farmers began to use it for forage. During the 1930s, the Soil Conservation Service promoted kudzu for erosion control. Can you predict what happened to kudzu in the United States after the 1930s?

- A. Kudzu thrives in sunny places and does an excellent job of erosion control. Grazing livestock love kudzu's leaves and the plant is still prized by farmers and soil conservationists.
- B. Kudzu did not survive well in the U.S. beyond 1950. Scientists believe that an American fungus, to which the Japanese-born kudzu was not resistant, wiped out the population. A similar-looking plant appeared in the Florida Everglades in the 1970s, but scientists say it is not kudzu.
- C. Kudzu grew in the eastern U.S. In fact, it grew too well. Kudzu vines grow as much as a foot per day, climbing trees, power poles, and anything else they contact. Its rapid growth rate threatens natural areas by killing native plants through crowding and shading.
- D. _____

Pigs in Hawaii

The first Polynesian settlers, who beached their canoes on Hawaii about 400 A.D., brought plants with them and also small pigs. The presence of these pigs led to the extinction of at least 35 species of birds because pigs ate the birds' eggs. Centuries later, in 1778, Captain James Cook introduced cattle, goats, sheep and large European pigs to Hawaii. Can you predict the effect these large pigs had on Hawaii?

- A. The European pigs, whose dense bodies with thick layers of fat were well adapted to European winters, were not able to withstand Hawaii's heat. No European pigs were spotted past 1800.
- B. Without any natural predators, the European pigs survived too well in Hawaii, destroying the habitat in the process. They spread ginger, which forms a dense carpet and keeps anything else from taking root. They knock down tall tree ferns and eat them.
- C. The jungle ecosystem that existed in Hawaii before 1778 welcomed the pigs, as well as the cattle, goats and sheep that came with them. The rich biodiversity of the area kept these new species under control, since they found new prey as well as new predators.
- D. _____

Additional Classroom Activities

As a class, investigate national, regional, state and local issues with introduced species. Assign students to trace the history of an introduced species in the U.S. and compare this with the history of an introduced species in another country. Try to locate examples of successful introduction of nonnative species and report on this.

Conclusions

The seven species selected for the vignettes here range from species of international importance and interest to those of regional importance and interest. The species featured in the vignettes include both plants and animals. All the featured animals are vertebrates—birds, reptiles, amphibians and mammals.

There is a wealth of information available on problems associated with introduced species. This activity is designed to introduce your students to this fascinating area of study and give them an opportunity to apply their ecological understanding to very real and very pressing issues of concern to all of us. Note: You may want to modify this activity to include species of more concern to you and your students, such as the green crab in the San Francisco Bay; zebra mussels in the Great Lakes; the melaleuca tree in the Everglades; rabbits, goats and pigs in Australia; or the mongoose in Hawaii.

For additional information, search the Internet and visit your school library, local public library, and affiliated university libraries. Local environmental groups can likely provide additional sources of information.

Answers for the teacher for the vignettes are as follows:

Brown tree snake—B
Cane toad—C
Coyotes—C
Goats—C
Bermuda kiskadee—A
Kudzu—C
Hawaiian pigs—B
Galapagos goats—B.

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